Cynosurus cristatus is included. This latter species is of limited value, and in permanent pasture only.

Genera are given pp. 4-11, and the following fifty pages are occupied by an account of those species which have up to the present been found in Great Britain or Ireland. The rest of the book is devoted to the sedges. The derivations of the names of genera are mostly given, as well as the French and German synonyms of the different species discussed. The illustrations are satisfactory, and are in general given for those species which are most common. That of *Triticum repens*, on p. 32, is perhaps exceptional. The beginner very often confuses the spike of this grass with that of some varieties of rye-grass. The spikelets of the latter are set edgewise to the rachis, whilst those of the former have their flat sides to the rachis; if the beginner is still in doubt the rootstock can be examined; this is stoloniferous in the case of couch-grass.

Elementary Plane Trigonometry. Clarendon Press Series. By R. C. J. Nixon, M.A. (Clarendon Press, Oxford, 1892.)

The author in his preface informs us that in writing this book he has tried to free his mind as far as possible from all current text-books, and to base this one solely on his experience of twenty-five years. That he has done this is soon seen when glancing through the pages, for the order of arrangement and general basis differ very considerably from those usually adopted. The line of demarcation he draws between elementary and higher works lies in the use and non-use of the symbol $\sqrt{-1}$, thus avoiding here altogether the use of imaginaries. An omission which may seem rather questionable is that of the theory of logarithms, which is here excluded as it does not appertain to trigonometry proper; the beginner is not left entirely without logarithms themselves, for there are two chapters in which he can make a slight acquaintance with them, together with one on the adaptation of formulæ to logarithmic calculation. Throughout the work the author has made a strong point of giving in their fulness and generality all definitions and proofs, while he has added also numerous examples, some of which are worked out to serve as specimens, while others are accompanied with hints as to their solution.

If any fault be found in the book it is perhaps that it has been expanded to too great dimensions: excluding the answers at the end there are no less than 364 pages, which, for an elementary work of this kind, is undoubtedly a large number. At any rate the error is made on the right side. In all other respects the book can be decidedly recommended, for the propositions are all neatly proved, and the get-up, as regards the figures and letters, could scarcely be surpassed.

Paraguay: The Land and the People, Natural Wealth and Commercial Capabilities. By Dr. E. de Bourgade La Dardye. English Edition. Edited by E. G. Ravenstein. (London: George Philip and Son, 1892.)

Every one who has any reason to be interested in Paraguay ought to read this book, which is in most respects a model of what such a work ought to be. The author spent two years in the country, so that he had ample opportunities for making himself acquainted with its leading characteristics. His impressions, upon the whole, were very favourable; but there is not the faintest attempt to convey an exaggerated idea either of Paraguay's resources or of the use she is making of them. M. de Bourgade writes in a spirit of scientific impartiality, bringing out the facts exactly in accordance with what he believes to be the most trustworthy evidence. He begins with an account of the geographical exploration of the country, then presents a geological survey, and describes the basins of the Parana and the Paraguay, and Paraguay's vegetable and animal life and minerals. Next there are chapters on various aspects of social life—government, and laws, financial position, real property, population, and immigration. A section on "Labour" includes chapters on means of communication, the soil, stock-breeding, agricultural products, tobacco, timber, textile plants, various raw materials, yerba-maté, and the orange. On all these subjects the author writes clearly and with full information. The work is enriched with a map and illustrations, and of the translation we need only say that it has been done carefully and adequately.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* Nature. *No notice is taken of anonymous communications.*]

Thunderstorms and Sunspots.

About six years ago Prof. von Bezold laid before the Bavarian Academy a memoir relating to lightning-flashes that had done damage to houses in Bavaria. In that kingdom the fire-insurance of buildings is entirely in the hands of the State, and a long series of statistical data on the subject was available.

Two things appeared from this inquiry—first, that those damaging lightning-flashes had enormously increased in the last fifty years (to 1882), much more than the increase of houses; and second, that there was apparently some relation between the phenomena and the sunspot cycle. To each maximum of sunspots corresponded a minimum of damaging lightning-flashes or thunderstorms (only in two cases one year displaced); but between each pair of minima was another secondary minimum not far from the minimum of sunspots. The curve of lightning damage, in fact, shows a double oscillation for each sunspot period, maxima of sunspots corresponding with the better-defined of the two minima of lightning damage. A somewhat similar result had been arrived at by Prof. Fritz from a study of thunderstorms in the Indian Archipelago, but he considered it adverse to the idea of a causal relation between sunspots and thunderstorms.

In an earlier paper to the Bavarian Academy (1874), Prof. von Bezold, from a study of several thunderstorm records, came to the conclusion that "high temperatures and a spotless solar surface give years abounding in thunderstorms." This supposed relation between sunspots and thunderstorms does not seem to have attracted much attention of late years. The object of this note is chiefly to show some curves and figures from thunderstorm records, which, it appears to me, yield further evidence of the relation.

In the diagram herewith are two curves, one for Berlin from 1850, the other for Geneva from 1852. The numbers of days of observed thunder are taken and grouped in averages, each yearly point of the curve representing an average of five years. The vertical scale-figures are to the left. Below is an inverted sunspot curve, with scale-figures to the right. The upper points of the latter are minima, and it will be observed how maxima of the thunderstorm curves occur over them or nearly so; and similarly with sunspot maxima and minima of the other curves. There is not always exact coincidence, but a very considerable correspondence will be noticed. (I do not here reproduce the figures yielding those curves.)

It is to be regretted that the official Greenwich records do not, so far as I know, contain any tabulated series of figures relating to thunderstorms in a long course of years. From an examination of the *Greenwich Observations* and the *Weekly Return*, I am enabled to present a table of the number of days on which thunder was observed during the six months April to September in each year from 1850 to 1891. The actual figures are given in one column, and another column gives smoothed values (five year averages). In the curve made from these smooth values, we find maxima corresponding closely with the sunspot minima of 1856 and 1878, and it is now, apparently, near another pro-

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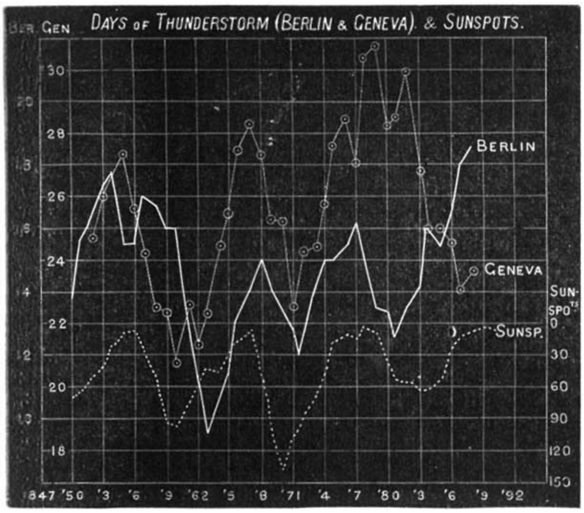
nounced maximum which would correspond with the sunspot minimum of 1889 (I may mention that the number of thunder days this year is, thus far, small, and the smoothed curve seems likely to go down). The sunspot minimum of 1867 seems not to be represented in the curve.

Whether or not we may regard this curve as lending support to the view in question, it may at least prove interesting to observe how our summer thunderstorms have varied in number of late years. The Thunderstorm Committee of the Royal Meteorological Society have not yet, I understand, attacked the question of a possible relation to sunspots. May it not be said, however, that the field looks promising?



While some other Continental records of thunderstorms treated in the same way yield results similar to those for Berlin and Geneva, there are some which cannot be said to support the view under consideration (though also not positively against it). When one reflects on the unsatisfactory nature of many thunderstorm records extending over a long series of years, vitiated by such things as a change of observers, or of the mode of observation or of record, &c., this need hardly be thought surprising.

Year.	Greenwich. Days Thunder (Apr.-Sept.).	Smoothed Values.	Year.	Greenwich. Days Thunder (Apr.-Sept.).	Smoothed Values.
1850	8	—	1871	12	10·4
1851	9	—	1872	17	11·8
1852	11	9·6	1873	9	12·2
1853	11	10·2	1874	12	12·0
1854	9	10·4	1875	11	11·0
1855	11	10·6	1876	11	14·4
1856*	10	11·4	1877	12	14·6
1857	12	12·6*	1878*	26	17·2*
1858	15	12·2	1879	13	16·8
1859	15	12·4	1880	24	15·6
1860	9	11·2	1881	9	13·6
1861	11	9·4	1882	6	13·2
1862	6	7·8	1883	16	11·0
1863	6	8·6	1884	11	10·8
1864	7	7·6	1885	13	10·8
1865	13	9·0	1886	8	11·4
1866	6	9·8	1887	6	13·8
1867*	13	9·4	1888	19	13·8
1868	10	8·6	1889*	23	16·2*
1869	5	9·8	1890	13	—
1870	9	10·6	1891	20	—

Minimum sunspots and maximum thunder days (smoothed values) indicated by an asterisk.

A. B. M.

The Nova Aurigæ.

THE Nova Aurigæ was observed on the night of September 14, with the Newall telescope, under favourable circumstances. It was almost exactly equal in brightness with the star 85″ nf; which of the two was brighter it was difficult to say, because of a peculiarity noted below, but its magnitude may be taken as close upon 10·3.

The spectrum, as seen with a compound prism between eye and eye-piece, showed a very faint continuous spectrum, varying from C to F (or? G);

- a bright line quite, or nearly, coincident with C;
- three bright lines close together in the green, the least refrangible one seeming considerably broader than the others;
- a faint bright line in the blue (? F);

and with great difficulty I saw at times a still fainter line in the violet. I failed to make out that the bright lines had the dark companions seen in the spring. At first sight the spectrum seemed to consist of a single broad bright line in the green.

With a power of 215 (without spectroscope) I at first thought that the Nova was diffuse, and resembled a minute planetary nebula rather than a star; but on focussing more carefully, I made out that the Nova was distinctly stellar; now, however, the neighbouring stars resembled planetary nebulæ. In fact the Nova and neighbouring stars could not be focussed simultaneously. With a power 500 the effect was of course more marked. The Nova owes its visual magnitude nearly entirely to the light that gives rise to the three green lines in the spectrum, and it is interesting to note that it was possible to verify a conclusion drawn from this fact and from the nature of the chromatic dispersion of a refractor of 29 feet focal length:—the image of the Nova was distinctly more point-like than that of the neighbouring equally bright star, when each in turn was focussed as carefully as possible.

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Ferndene, Gateshead-on-Tyne.

Atmospheric Depressions and their Analogy with the Movements of Sunspots.

A SOMEWHAT prolonged absence from home has prevented me seeing until now your note on July 21, page 280, in which the writer remarks that the results of M. Camille Flammarion—published in the July number of *L'Astronomie*—"seem to confirm the view suggested by M. Faye that the constitution of [sun] spots resembles somewhat that of the cyclones with which we are familiar."

I write to point out that this is not the theory of M. Faye, but, on the contrary, is the theory of Mr. Herbert Spencer, which he published in the *Reader* for February 25, 1865, and which has since been republished in his collected essays under the title, "The Constitution of the Sun." In it Mr. Spencer first points out the untenability of M. Faye's hypothesis, and then goes on to say:—"The explanation of the solar spots above suggested, which was originally propounded in opposition to that of M. Faye, was eventually adopted by him in place of his own. In the *Comptes Rendus* for 1867, vol. lxiv., p. 404, he refers to the article in the *Reader*, partly reproduced above, and speaks of me as having been replied to in a previous note. Again, in the *Comptes Rendus* for 1872, vol. lxxv., p. 1664, he recognizes the inadequacy of his hypothesis, saying:—'Il est certain que l'objection de M. Spencer, reproduit et développée par M. Kirchoff, est fondée jusqu'à un certain point; l'intérieur des taches, si ce sont des lacunes dans la photosphère, doit être froid relativement . . . . Il est donc impossible qu'elles proviennent d'éruptions ascendantes.' He then proceeds to set forth the hypothesis that the spots are caused by the precipitation of vapour in the interiors of cyclones. But though, as above shown, he refers to the objection made in the foregoing essay to his original hypothesis, and recognizes its cogency, he does not say that the hypothesis which he thereupon substitutes is also to be found in the foregoing essay. Nor does he intimate this in the elaborate paper on the subject read before the French Association for the Advancement of Science, and published in the *Revue Scientifique* for March 24, 1883. The result is that the hypothesis is now currently ascribed to him. I should add that, while M. Faye ascribes solar spots to clouds formed within cyclones, we differ concerning the nature of the cloud. I have argued that it is

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